

## THE CLAIMS

What is claimed is:

1. A golf ball comprising:

5           a center comprising:

              a resilient polymer comprising polybutadiene having a molecular weight of  
              greater than about 200,000;

10          a crosslinking material present in an amount of about 10 to about 40 parts per  
              hundred of the resilient polymer;

              a free radical source present in an amount of about 0.1 to about 15 parts per  
              hundred of the resilient polymer;

              a cis-to-trans catalyst present in an amount of about 0.1 to about 10 parts per  
              hundred of the resilient polymer; and

15          a cover comprising a thermoplastic or thermoset polyurethane.

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2. The golf ball of claim 1, wherein the molecular weight of the polybutadiene is greater than about 250,000.

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3. The golf ball of claim 2, wherein the molecular weight of the polybutadiene is from about 300,000 to about 500,000.

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4. The golf ball of claim 1, wherein the polybutadiene comprises less than about 7 percent vinyl isomer.

5. The golf ball of claim 4, wherein the polybutadiene comprises less than about 4 percent vinyl isomer.

6. The golf ball of claim 1, wherein the cis-to-trans catalyst comprises an organosulfur compound.

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7. The golf ball of claim 6, wherein the organosulfur compound comprises a metal.

8. The golf ball of claim 1, wherein the cis-to-trans catalyst comprises an aromatic organic compound.
- 5        9. The golf ball of claim 8, wherein the aromatic organic compound comprises a fused ring C<sub>6</sub> to C<sub>24</sub> aromatic group.
- 10      10. The golf ball of claim 8, wherein the aromatic organic compound comprises a hydroxy group, a metal salt of a hydroxyl, or a combination thereof.
11. The golf ball of claim 8, wherein the aromatic organic compound comprises a mercapto group, a metal salt of a mercapto group, or a combination thereof.
12. The golf ball of claim 1, wherein the polyurethane comprises an isocyanate selected from the group consisting of 4,4'-diphenylmethane diisocyanate, polymeric MDI, carbodiimide-modified liquid MDI, 4,4'-dicyclohexylmethane diisocyanate, *p*-phenylene diisocyanate, toluene diisocyanate, 3,3'-dimethyl-4,4'-biphenylene diisocyanate, isophoronediisocyanate, hexamethylene diisocyanate, naphthalene diisocyanate; xylene diisocyanate; para-tetramethylxylene diisocyanate; meta-tetramethylxylene diisocyanate; ethylene diisocyanate; propylene-1,2- diisocyanate; tetramethylene-1,4-diisocyanate; cyclohexyl diisocyanate; 1,6-hexamethylene- diisocyanate; dodecane-1,12-diisocyanate; cyclobutane-1,3- diisocyanate; cyclohexane-1,3- diisocyanate; cyclohexane-1,4- diisocyanate;
- 20      25      1-isocyanato-3,3,5- trimethyl-5- isocyanatomethylcyclohexane; methyl cyclohexylene diisocyanate; triisocyanate of hexamethylene diisocyanate; triisocyanate of 2,4,4-trimethyl- 1,6-hexane diisocyanate, tetracene diisocyanate, naphthalene diisocyanate, anthracene diisocyanate, and mixtures thereof.
- 30      13. The golf ball of claim 12, wherein the isocyanate is 4,4'-diphenylmethane diisocyanate.

14. The golf ball of claim 12, wherein the isocyanate is 4,4'-dicyclohexylmethane diisocyanate.

5        15. The golf ball of claim 1, wherein the polyurethane comprises less than about 0.1 percent free monomer groups.

10      16. The golf ball of claim 1, wherein the polyol is selected from the group consisting of a polyether polyol, hydroxy-terminated polybutadiene, polyester polyol, polycaprolactone polyol, polycarbonate polyol, or mixtures thereof.

15      17. A golf ball comprising:  
          a center comprising:  
            a resilient polymer comprising polybutadiene having a molecular weight of  
            greater than about 200,000;  
            a crosslinking material present in an amount of about 10 to about 40 parts per  
            hundred of the resilient polymer;  
            a free radical source present in an amount of about 0.1 to about 15 parts per  
            hundred of the resilient polymer;  
            a cis-to-trans catalyst present in an amount sufficient to produce a resilient  
            polymer comprising about 12 percent or greater trans-polybutadiene  
            isomer; and  
            a cover formed of a castable reactive liquid material, wherein the cover has a  
            hardness of about 30 Shore D to about 60 Shore D.

20      18. The golf ball of claim 17, wherein the free radical source comprises an organic  
          peroxide.

25      19. The golf ball of claim 17, wherein the cis-to-trans catalyst comprises 4,4'-diphenyl  
          disulfide, 4,4'-ditolyl disulfide, 2,2'-benzamido diphenyl disulfide, or a combination  
          thereof.

30      20. The golf ball of claim 17, wherein the cis-to-trans catalyst is present in an amount of  
          about 0.1 to about 8 parts per hundred of the resilient polymer.

21. The golf ball of claim 17, wherein the castable reactive liquid material comprises urethane.